

the now comparatively worthless low-lying lands bordering on the Yarra Yarra River.

In preparing this paper and accompanying diagrams, I have been and am much indebted to the kind courtesy of Commander Cox, and the Government astronomer, Mr. Ellery, for the use of the tide and meteorological registers necessary for the compilation of the facts put forward, and take this opportunity of tendering my thanks for the same.

Melbourne, 10th October, 1864.

ART. XL.—*Abel's Fuses and Wheatstone's Exploder.* By
R. L. J. ELLERY, ESQ., F.R.A.S.

[Read 18th July, 1864.]

Mr. Ellery (the Government Astronomer) exhibited some of Abel's patent fuses, with an instrument called "Wheatstone's Exploder," together forming a most convenient and powerful means of firing gunpowder by electricity.

Mr. Ellery described the exploder, which is in fact a portable magneto-electric apparatus, as consisting of a set of compound permanent magnets, arranged around a cube, armed with electro-magnetic coils, in front of the poles of which, soft iron armatures could be made to revolve rapidly by turning a handle, giving rise to a pretty powerful induced electric current in the fuse covering wire of the coil; which, by means of suitable connections, could be conducted to considerable distances through properly insulated wire. The whole apparatus was conveniently enclosed in a mahogany case, 8 or 9 inches square, and weighed about 30 pounds.

The fuses exhibited were of two kinds. The ones for firing guns were very similar in appearance to the ordinary friction tube, with the exception that to one end was attached a small knob of beech wood, perforated with two holes, which were copper-lined and served to hold the connecting wires when ready for firing. The other fuses were adapted to blasting purposes, and consisted of a small wooden cartridge filled with powder, to which was attached a pair of insulated wires about two feet long, with which the connecting wires had to be joined when used. The principal point of interest in these fuses was the use of a peculiar composition, very susceptible of ignition by the slightest electric spark. This composition was placed in contact with the two

ends of the conducting wires, which were separated very slightly, but effectually, with the fuse itself. The passage of the spark across the small space between the wires ignites the composition, and thence the gunpowder. This composition, Mr. Ellery stated, was the result of considerable experiment and research on the part of Mr. Abel, the patentee, the chemist to the War Department. It consists of a mixture of a Phosphide and a Sulphide of Copper with Chlorate of Potash, in such nicely balanced proportions that it offered just sufficient resistance to the passage of the electric spark to ensure ignition, but not sufficient to hinder the passage of a moderately weak spark.

After practically illustrating the efficacy of the exploder in firing these fuses through considerable lengths of insulated wire, Mr. Ellery proceeded to show the great facility and immunity from accident this method of firing gunpowder offered in mining and other engineering operations, and pointed out with what simplicity arrangements could be made in large mines for adopting it. He remarked that it not only admitted of a very considerable number of blasts being fired at the same moment from a considerable distance, but would tend to obviate entirely those accidents so frequently occurring through the smouldering of the ordinary tube fuse. He further drew attention to the great superiority of the exploder and Abel's fuses to the ordinary method of firing gunpowder by electricity, by means of a powerful voltaic battery, especially in submarine operations.